REMARKS

The above-identified patent application has been amended and Applicants respectfully request the Examiner to reconsider and again examine the claims as amended.

Claims 1 and 4-35 are pending in the application. Claims 12, 20, and 23 are objected to, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 1-11, 13-19, 21, 22, and 24 are rejected. Claim 1 is amended herein. Claims 2 and 3 are cancelled herein without prejudice. Claims 25-35 are new.

The Rejections under 35 U.S.C. §112, Second Paragraph

The Examiner rejects Claims 19-24 under 35 U.S.C. §112 second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. With regard to Claim 19, the Examiner asserts that regarding "'...selected to provide an increased flux density' it is unclear what the flux density will be increased from." Applicants respectfully disagree.

Applicants submit that it is clear that the claimed increased flux density is an increase in flux density resulting from the claimed etching of the current conductor portion. Therefore, the increased flux density is in relation to the flux density that would be achieved in the absence of the claimed etching.

In view of the above, Applicants submit that the rejection of Claims 19-24 under 35 U.S.C. §112, second paragraph, should be removed.

The Rejections under 35 U.S.C. §102(b)

The Examiner rejects Claims 1-3, 8-11, 13, 17-19, 21, 22, and 24 under 35 U.S.C. §102(b) as being anticipated by Steiner et al. (U.S. Patent number 6,356,068)

Applicants have amended Claim 1 herein to recite "...a substrate having first and second opposing surfaces, the first surface proximate to said current conductor portion and the second surface distal from said current conductor portion; *wherein said substrate is disposed having the first surface of said substrate above said current conductor portion and the second surface above the first surface when the leads are in electrical contact with an uppermost surface of a circuit board*; and one or more magnetic field transducers disposed on the first surface of said substrate." Support for this amendment can be found, for example, in FIG. 1, as described at page 4, lines 17-23.

Applicants submit that amended Claim 1 is patentably distinct over Steiner et al., since the cited reference neither describes nor suggests "...a substrate having first and second opposing surfaces, the first surface proximate to said current conductor portion and the second surface distal from said current conductor portion; *wherein said substrate is disposed having the first surface of said substrate above said current conductor portion and the second surface above the first surface when the leads are in electrical contact with an uppermost surface of a circuit board; and one or more magnetic field transducers disposed on the first surface of said substrate*," as set forth in Claim 1.

With this particular arrangement, the present invention provides an arrangement (e.g., as shown in FIG. 1) for which a substrate 16 is mounted in an integrated circuit 10 in conjunction with a lead frame 12 having a current conductor portion 14 such that the substrate 16 "...has an orientation that is upside down (i.e., the first surface 16a is directed downward) relative to a conventional orientation with which a substrate is mounted in an integrated circuit package." (page 4, lines 21-23). The substrate 16 has a magnetic field transducer 18 "...diffused into the first surface 16a, or otherwise disposed on the first surface 16a." (page 4, lines 11-13) Therefore, the first surface 16a, which includes the magnetic field transducer 18, is directed downward toward the current conductor portion 14.

In contrast, as shown in Fig. 1, Steiner et al. describes a current monitor system including a die 1 having two integrated Hall sensors 2, which are on a top surface of the die 1. The current monitoring system of Steiner et al. includes leads 4 and a current path 5. Both surfaces of the die 1 are beneath the leads 4 and beneath the current path 5. Applicants point out that the wire bonds 10 (see e.g., Fig. 5) are not leads and are not indicative of a mounting orientation of the current monitor system relative to a circuit board. Instead, as best understood by the Applicants, the orientation for mounting to a circuit board is determined by pins 11 (Fig. 7), where it can be seen that both surfaces of the die 1 are beneath the leads 4 and beneath the current path 5 when the leads 4 are in electrical contact with an uppermost surface of a circuit board. Therefore, Steiner et al. does not teach the claimed arrangement in which both surfaces of the substrate are above the current conductor when the leads are in electrical contact with an uppermost surface of a circuit board.

In view of the above, Applicants submit that Claim 1 is patentably distinct over Steiner et al.

Claims 2 and 3 are cancelled herein without prejudice. Claims 8-11, 13, 17, and 18 depend from and thus include the limitations of Claim 1. Thus, Applicants submit that Claims 8-11, 13, 17, and 18 are patentably distinct over the cited reference at least for the reasons discussed above in conjunction with Claim 1.

Applicants submit that Claim 9 is further patentably distinct over Steiner et al., since the cited reference neither describes nor suggests that the claimed substrate is "... associated with a selected one of a solder ball, a gold bump, a eutectic and high lead solder bump, a no-lead solder bump, a gold stud bump, a polymeric conductive bump, an anisotropic conductive paste, and a conductive film coupled to a corresponding one of the plurality of leads," as set forth in Claim 9. The claimed arrangement provides electrical coupling to the plurality of leads without conventional wire bonds. In contrast, Steiner et al. teaches only wire bonds 10, for example, in Fig. 5, which are coupled to the leads 4.

Applicants submit that independent Claim 19 is patentably distinct over Steiner et al., since the cited reference neither describes nor suggests "... etching the current conductor portion to provide the current conductor portion with a cross section having a predetermined shape selected to provide an increased flux density," as set forth in Claim 19.

A result of the claimed etching is found in FIGS. 9 and 9A. With respect to FIG. 9, it is described at page 18, lines 1-15

> "A current conductor portion 254 has a surface 254a and a thickness t1 which can be the same as or similar to the thickness of others of the thinned portion 252b-252n. Other portions of the lead frame have a thickness t2. In one particular embodiment, the thickness t1 of the current carrying portion 254 is the same as the thickness of the other thinned portions 252b-252n, and the thickness t1 is approximately half of the thickness t2. In one embodiment, the current conductor portion 254 has a cross section that is essentially rectangular, having the thickness t1.
>
> It will be recognized that, in the presence of a current passing through the current conductor portion 254, the current conductor portion 254 being thinner, for example, than the current conductor portion 74 of FIG. 3, has a higher current density near the surface 254a than the current conductor portion 74 of FIG. 3 has near the surface 74a in the presence of a similar current. In other words, the current is compressed to be closer to the surface 254a than it would otherwise be with a thicker current conductor portion. As a result, a magnetic field generated by the current has a higher flux density in proximity to the surface 254a."

Applicants can find no mention in Steiner et al. of etching the lead frame 7, or of etching the current path 5. Applicants further submit that in Steiner et al. there is no suggestion that the lead frame 7 is formed by any special process, and therefore, Applicants presume that the lead frame 7 is formed by a conventional stamping process, without etching.

In view of the above, Applicants submit that Claim 19 is patentably distinct over Steiner et al.

Claims 21, 22, and 24 depend from and thus include the limitations of Claim 19. Thus, Applicants submit that Claims 21, 22, and 24 are patentably distinct over the cited reference at least for the reasons discussed above in conjunction with Claim 19.

Applicants submit that Claim 21 is further patentably distinct over Steiner et al., since, with regard to the claimed predetermined shape of the cross section of the current conductor portion, the cited reference neither describes nor suggests "...the predetermined shape comprises a rectangular shape having a minimum dimension less than a thickness of said lead frame," as set forth in Claim 21. In contrast, current path 5 as shown in Fig. 2 of Steiner et al. is a part of the lead frame 7, apparently having the same thickness as the rest of the lead frame 7. The current path 5 of Steiner et al. apparently retains the same cross-sectional shape throughout the manufacturing steps indicated in Figs. 2-7.

For substantially the same reasons as those set forth above in conjunction with Claim 21, Applicants submit that Claim 24 is further patentably distinct over Steiner et al., since, with regard to the claimed predetermined shape of the cross section of the current conductor portion, the cited reference neither describes nor suggests "... the predetermined shape comprises a rectangular shape having a minimum dimension less than a thickness of said lead frame," as set forth in Claim 24.

In view of the above, Applicants submit that the rejection of Claims 1-3, 8-11, 13, 17-19, 21, 22, and 24 under 35 U.S.C. §102(b) should be removed.

The Rejections under 35 U.S.C. §103(a)

Steiner et al. in View of McDonald et al.

The Examiner rejects Claims 4-7 under 35 U.S.C. §103(a) as being unpatentable over Steiner et al. in view of McDonald (U.S. Patent number 4,893,073). With regard to Claim 4, the Examiner recognizes that Steiner et al. does not teach the claimed conductive clip. The Examiner relies upon McDonald et al. to teach the claimed conductive clip.

Applicants submit that Claims 4-7 are patentably distinct over Steiner et al., whether taken alone or in combination with McDonald et al., since the cited references neither describe nor suggest "...a substrate having first and second opposing surfaces, the first surface proximate to said current conductor portion and the second surface distal from said current conductor portion; *wherein said substrate is disposed having the first surface of said substrate above said current conductor portion and the second surface above the first surface when the leads are in electrical contact with an uppermost surface of a circuit board; and one or more magnetic field transducers disposed on the first surface of said substrate*," as set forth in Claim 1 on which Claims 4-7 depend.

As described above, with this particular arrangement, the present invention provides an arrangement (e.g., as shown in FIG. 1) for which a substrate 16 is mounted in an integrated circuit 10 in conjunction with a lead frame 12 having a current conductor portion 14 such that the substrate 16 "...has an orientation that is upside down (i.e., the first surface 16a is directed downward) relative to a conventional orientation with which a substrate is mounted in an integrated circuit package." (page 4, lines 21-23). The substrate 16 has a magnetic field transducer 18 "...diffused into the first surface 16a, or otherwise disposed on the first surface 16a." (page 4, lines 11-13) Therefore, the first surface 16a, which includes the magnetic field transducer 18, is directed downward toward the current conductor portion 14.

In contrast, Steiner et al. describes a current monitor system, having, as shown in Fig. 1, a die 1 including two integrated Hall sensors 2, which are on a top surface of the die 1. The current monitoring system of Steiner et al. includes leads 4 and a current path 5. Unlike the present invention, both surfaces of the die 1 are beneath the leads 4 and beneath the current path 5.

Applicants submit that McDonald et al. fails to overcome the above deficiencies in Steiner et al. McDonald et al. describes an electric circuit board current sensor for which a current trace 11 (Fig. 2) is not part of an integrated circuit, but is instead a conductive trace on a

surface of a circuit board 10. Applicants submit that the current trace 11 does not form a current conductor portion as claimed, which is formed by a coupling of leads associated with a lead frame. Moreover, even as to the current trace 11, McDonald et al. does not teach the claimed substrate disposed having the first surface of the substrate above the current trace portion and the second surface above the first surface when the leads are in electrical contact with an uppermost surface of a circuit board.

In view of the above, Applicants submit that Claims 4-7 are patentably distinct over Steiner et al, whether taken alone or in combination with McDonald et al.

Applicants submit that Claims 4-7 are further patentably distinct over Steiner et al., whether taken alone or in combination with McDonald et al., since the cited references neither describe nor suggests that the "... current conductor portion further comprises a conductive clip coupled to the at least two of the plurality of leads," as set forth in Claim 4.

With this particular arrangement, as shown, for example, in FIGS. 7 and 8, the conductive clip 204 brings the resulting current path through the conductive clip 204 in proximity to a Hall element 208. As described at page 16, lines 3-4, "[t]his position results in a greater voltage output from the Hall effect element 208, and therefore improved sensitivity."

The Examiner relies upon McDonald et al. to teach the claimed conductive clip. However, Applicants submit that the Examiner is referring to McDonald's flux member 20, not a conductive clip as claimed. Current to be sensed by the electric circuit board current sensor of McDonald et al. flows though a current trace 11 and not through the flux member 20. Furthermore, the flux member 20 of McDonald et al. does not couple to leads as does the claimed conductive clip. Therefore, Applicants submit that McDonald et al. does not teach the claimed arrangement for which that the current conductor portion comprises a conductive clip coupled to the at least two of the plurality of leads.

In view of the above, Applicants submit that the rejection of Claims 4-7 under 35 U.S.C. §103(a) should be removed.

Steiner et al. in View of Ohtsuka et al.

The Examiner rejects Claims 14-16 under 35 U.S.C. §103(a) as being unpatentable over Steiner et al. in view of Ohtsuka (U.S. Patent number 6,683,448). The Examiner recognizes that Steiner et al. does not disclose at least one amplifier disposed on the substrate. The Examiner relies upon Ohtsuka as teaching a current detector having an amplifier. The Examiner concludes that "...it would have been obvious to one having ordinary skill in the art at the time the invention was made to have amplifiers as taught by Ohtsuka... ."

Applicants submit that Claims 14-16 are patentably distinct over Steiner et al., whether taken alone or in combination with Ohtsuka, since the cited references neither describe nor suggest "...a substrate having first and second opposing surfaces, the first surface proximate to said current conductor portion and the second surface distal from said current conductor portion; *wherein said substrate is disposed having the first surface of said substrate above said current conductor portion and the second surface above the first surface when the leads are in electrical contact with an uppermost surface of a circuit board; and one or more magnetic field transducers disposed on the first surface of said substrate*," as set forth in Claim 1 on which Claims 14-16 depend.

Applicants submit that Ohtsuka et al. fails to overcome the above deficiencies in Steiner et al. Ohtsuka et al. describes, for example in Fig. 2, an arrangement for which a Hall effect element 1 is associated with a top surface of a substrate 18. The top surface of the substrate is disposed away from leads 3, 4 and baseplate 2 (i.e., away from a lead frame).

In view of the above, Applicants submit that the rejection of Claims 14-16 under 35 U.S.C. §103(a) should be removed.

Claims 25-35 are new in the application. Consideration of new Claims 25-35 is respectfully requested.

The Claim Objections

The Examiner objects to Claims 12, 20, and 23 as being dependent upon a rejected base claim, but indicates that Claims 12, 20, and 23 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claim.

For the above reasons, Applicants submit that independent Claim 1, from which Claim 12 depends, and independent Claim 19, from which Claims 20 and 23 depend, are patentably distinct over the cited references. Therefore, Applicants submit that Claims 12, 20, and 23 are allowable in their present dependent form.

In view of the above Amendment and Remarks, Applicants submit that the claims and the entire case are in condition for allowance and should be sent to issue and such action is respectfully requested.

The Examiner is respectfully invited to telephone the undersigning attorney if there are any questions regarding this Amendment or this application.

The Assistant Commissioner is hereby authorized to charge payment of any additional fees associated with this communication or credit any overpayment to Deposit Account No. 500845, including but not limited to, any charges for extensions of time under 37 C.F.R. §1.136.

Respectfully submitted,

Dated: Jan 18, 2005

DALY, CROWLEY & MOFFORD, LLP

By: _____

Kermit Robinson
Reg. No. 48,734
Attorney for Applicant(s)
275 Turnpike Street, Suite 101
Canton, MA 02021-2354
Tel.: (781) 401-9988, ext. 24
Fax: (781) 401-9966
kr@dc-m.com

\\server01\client_files\Prolaw documents\ALLEG-039PUS\3803.doc